

# FOREST CONTROL

A1323  
In 81  
77

## by CONTINUOUS INVENTORY

"Today I have grown taller from walking  
with the trees."

...Karle Wilson

Milwaukee, Wis. August, 1960 No. 77

### AS YOUNG AS YOUR FAITH

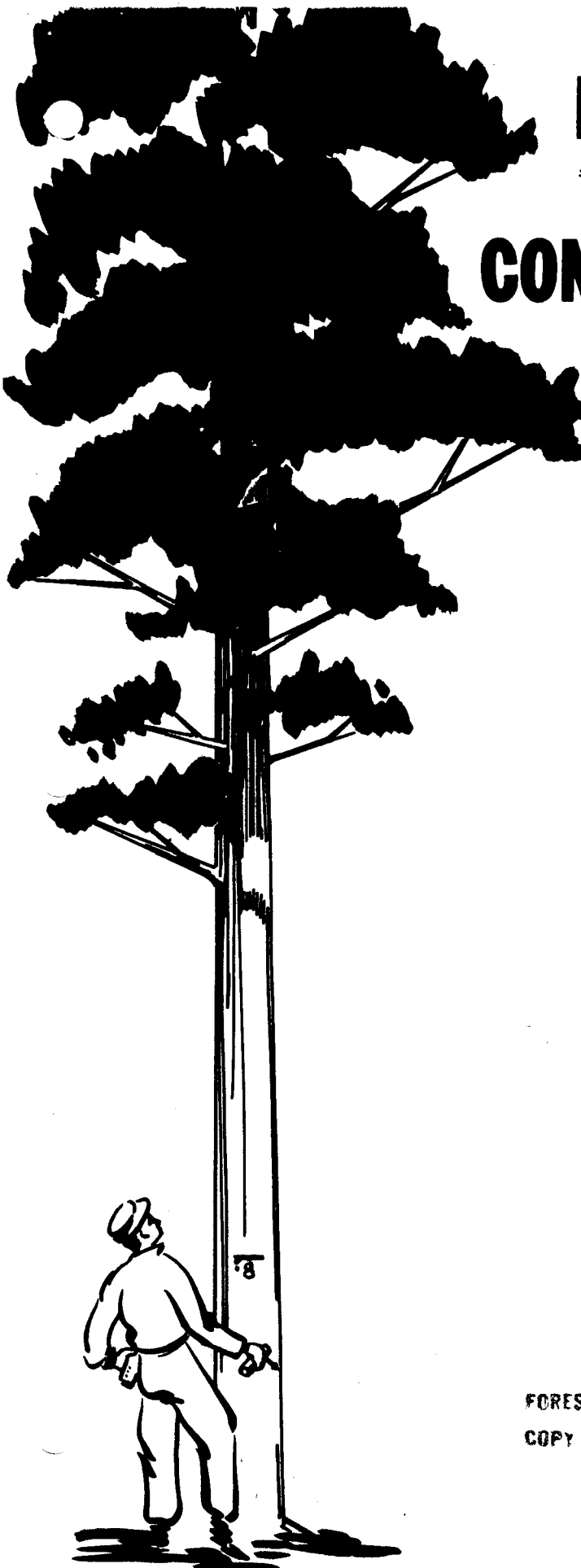
YOUTH is not entirely a time of life-  
it is a state of mind. It is not wholly  
a matter of ripe cheeks, red lips or  
supple knees. It is a temper of the will,  
a quality of the imagination, a vigor of  
the emotions ..... Nobody grows old by  
merely living a number of years. People  
grow old only by deserting their ideals.  
You are as young as your faith, as old  
as your doubt; as young as your self con-  
fidence, as old as your fear; as young  
as your hope, as old as your despair. In  
the central place of every heart there  
is a recording chamber; so long as it  
receives messages of beauty, hope, cheer  
and courage, so long are you young.  
When the wires are all down and your  
heart is covered with the snows of  
pessimism and the ice of cynicism, then,  
and then only, are you grown old.

Charles Kettering

On Research, A State of Mind

FORESTRY SCHOOL LIBRARY

COPY NO. \_\_\_\_\_



REGION NINE'S SITE INDEX CURVES ARE CONVENIENT FIELD TOOLS \*

Information taken on CFI plots is of two kinds. One deals with the dimensions and characteristics of individual trees, and the other with a description of the forest community within the plot area. Among the forest description items is the classification of site quality.

Forest site determination requires the combined use of plot area description as well as certain tree detail information. The measured height and age of the average dominant tree within or adjacent to the plot is essential. If no trees are present there should be some judgment of soil condition, aspect, drainage and slope position to determine a suitable site index. Site index decisions are best suited to relatively pure stands of even age, but forests of two or more age classes, and all-aged forests as well, can be classified. Site quality is at best a broad and loose quantity to determine, and looser still to subsequently apply. However, much good and useful information can come from a measurement and use of site in CFI.

Site is a single, quantitative expression of a multitude of factors that go to make up forest soils. It is a simple classification to use and provides a relative measure of the productivity of the soil. Its chief value is in the management of even aged pulpwood stands, and once determined it will change little over long periods of time. Site is important in evaluating and predicting the quantity of wood which will be available at some future date.

Permanent plot data taken in fixed radius plots which have been classified for site index can provide a knowledge of stand behavior important to the long range management of any forest property. We go so far as to say that ultimately every forest should be completely mapped for site since it is of primary concern in deciding the intensity of management practice over the years, particularly in plantations. It is not difficult to foresee that the information gained from a study of the producing power of forest soils in continuous inventory plots will ultimately supply decisive knowledge of earning power for broad forest areas, as well as help to establish policies of land purchase, sale and exchange.

Site is of increasing importance in forest management and we are fortunate to be able to supply site index curves, most of which were prepared for the North Central Region by the Lake States Forest Experiment Station. Developed from individual Technical Note sheets, a sample of which is included, the composite page of site index curves is of direct value and use in the woods.

Each Technical Note sheet gives three limitations to be considered when using site index curves. In addition to these there are five other points to consider when determining site index in the woods:

1. In mixed stands measure dominant or co-dominant trees of the predominating species.
2. Due to the sometimes abrupt fluctuation of site -- even within a sample plot -- be sure to measure trees of the same apparent site occupied by most of the plot area.
3. The attached balsam fir and white spruce site index curves are based on age at DBH. All other curves are based on total age, and require an increment boring at the base of the tree, or if bored at DBH, an allowance is required for the years to grow to DBH. Two years are added for hardwoods and five years for softwoods.
4. Care in using the graphs is important. To prevent errors of interpolation be careful to select the proper axis of the graph. Height on the left margin and age on the right have approximately the same numerical values.
5. There is a tendency in CFI inventories to evaluate site in a few broad classes such as good, fair, poor, off-site and permanently non-productive. This results many times in an adequate classification, but it is sometimes desirable to secure a more definite classification. Here is where site index becomes convenient, giving values in tens or even in units if desired.

\* LAKE STATES FOREST EXPERIMENT STATION TECHNICAL NOTES ON SITE INDEX INCLUDE Nos. 463, 464, 465, 472, 473, 474, 483, 484, 485, 498 and 541.

U.S.D.A. Technical Bulletin No. 560 (oak)

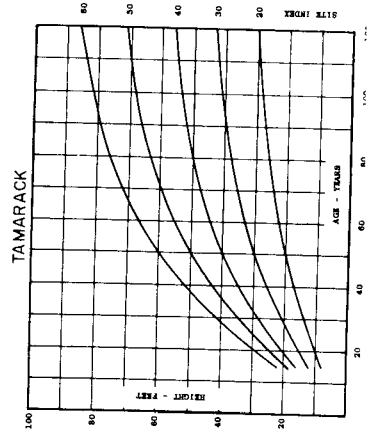
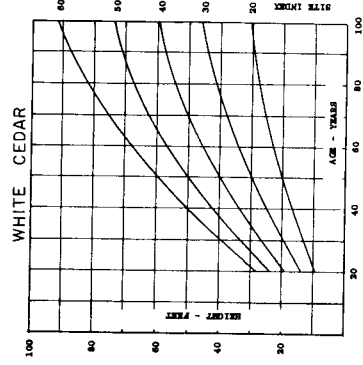
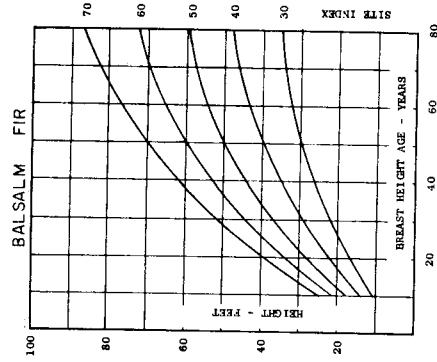
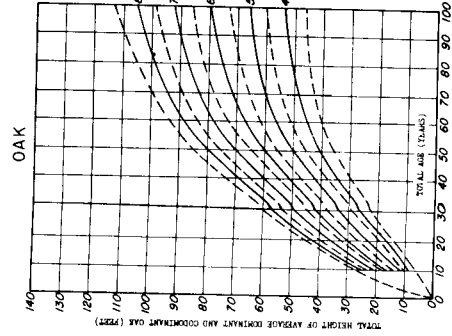
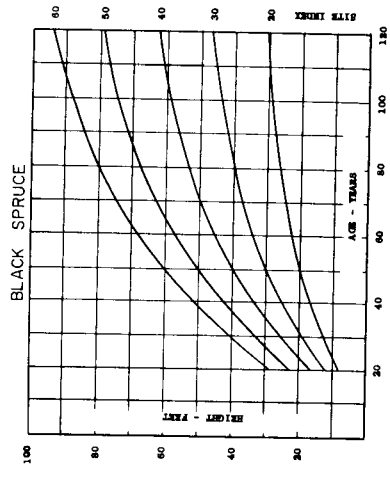
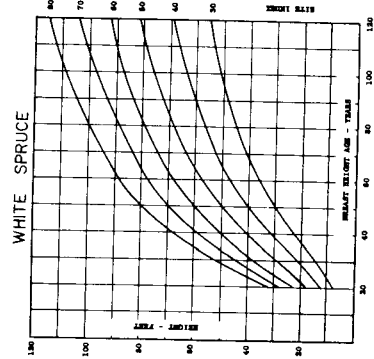
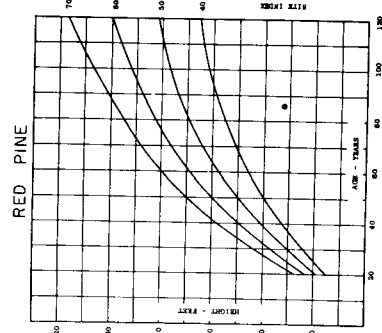
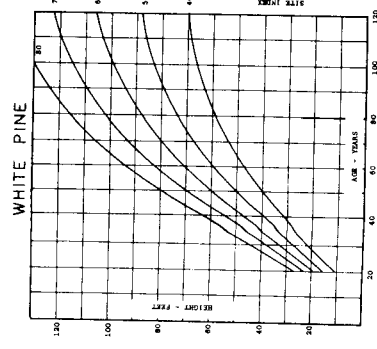
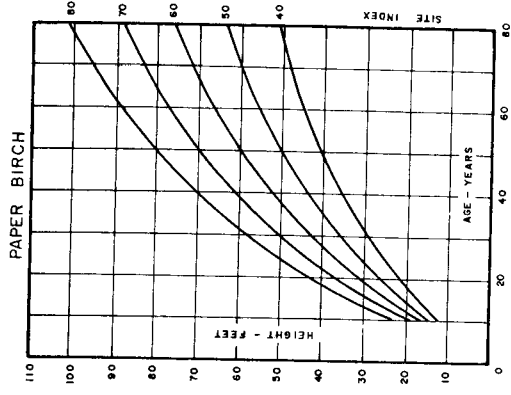
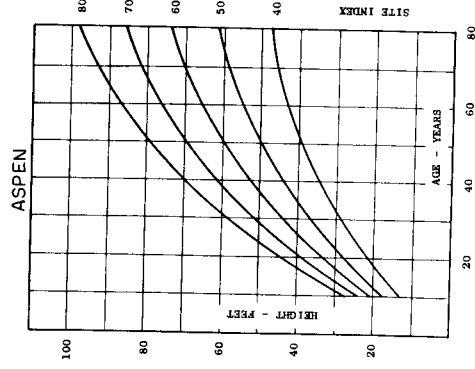
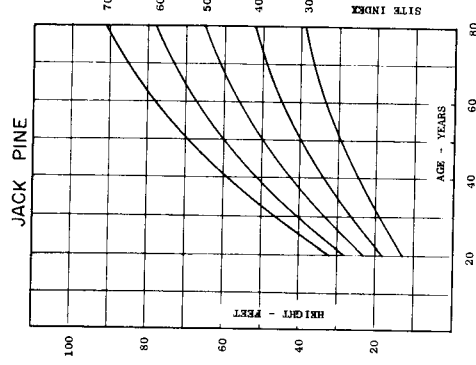
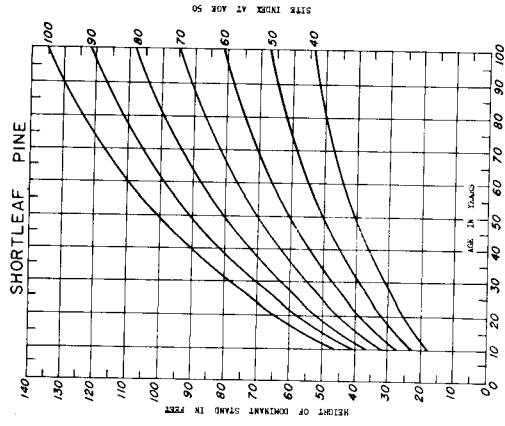
Journal of Forestry, 51-432-435 (shortleaf pine)

Enclosures

CAL STOTT,  
Forester  
U. S. Forest Service, Region 9

# SITE INDEX CURVES

REGION 9



# TECHNICAL NOTES

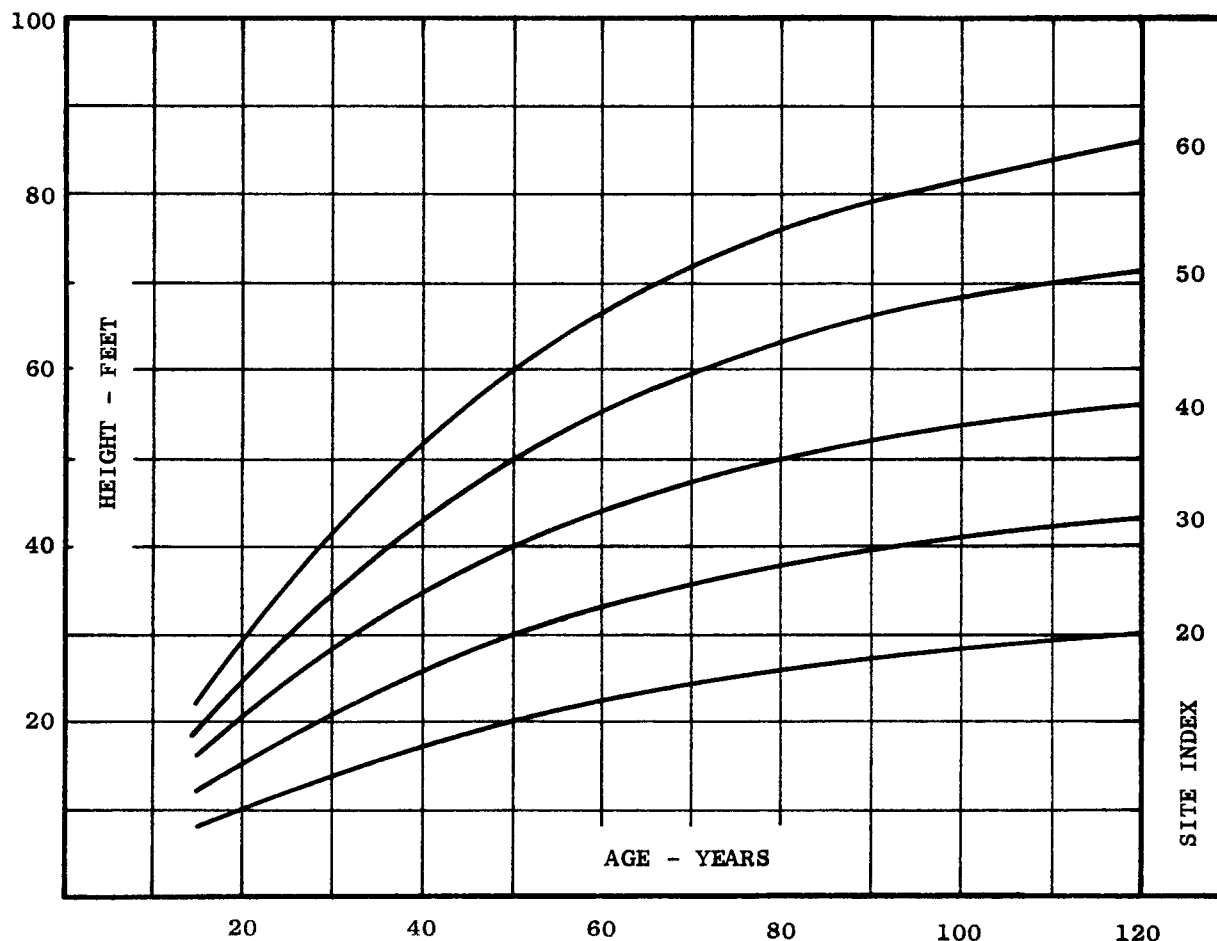
LAKE STATES FOREST EXPERIMENT STATION  
U.S. DEPARTMENT OF AGRICULTURE · · FOREST SERVICE

No. 498

## Site Index Curves for Tamarack in the Lake States

This site index graph is one of a series prepared for commercially important species in the Lake States. Some of the basic material has appeared in previous publications, most of which are no longer available. Because of field demand, the series is being published in convenient looseleaf form as technical notes. A statement on site index use and limitations is on the reverse side.

### TAMARACK



Source: Based on forest survey data collected in Minnesota during 1947-49 by the Lake States Forest Experiment Station and the Office of Iron Range Resources and Rehabilitation.

July 1957

S. R. GEVORKIANTZ, Forester

MAINTAINED AT ST. PAUL I, MINNESOTA, IN COOPERATION WITH THE UNIVERSITY OF MINNESOTA

## Site Index--Its Use and Limitations

Site index is the height attainable by the average dominant and codominant trees in relatively pure, even-aged, and well-stocked stands at the age of 50 years. It reflects the combined effect of different environmental factors and is used as a measure of stand productivity.

To evaluate site index, a number of sample trees in a stand should be measured for total height and age. Only dominant and codominant trees should be used. These trees are part of the main canopy or extend above it, receiving full light from above but comparatively little from the sides. A good rule-of-thumb for an adequate sample of height measurements or age borings is

$$n = 5 + \frac{R^2}{30}$$

where R = observed range of total heights or ages in the stand. The selection of these sample trees should be made in some systematic manner, covering the range of diameter classes to insure a representative sample. The curves recognize total age except for white spruce and balsam fir where age at breast height is used.

After the sample tree measurements have been taken, the average total height and the average age should be computed, using basal areas or squares of diameters as weights. A sample calculation is given below:

D.b.h. (inches)	Dominant and codominant heights (feet) (d)	Average height (feet) (h)	Number of samples (n)	Computations			
				(d <sup>2</sup> )	(nd <sup>2</sup> )	(w) <sup>1/</sup>	(wh)
7	48, 52	50	2	49	98	1.0	50
8	52, 55, 58	55	3	64	192	2.0	110
9	56, 57, 58	57	3	81	243	2.5	142
10	58, 60	59	2	100	200	2.0	118
Sum				10		7.5	420
Average height = $\frac{420}{7.5}$				= 56			

<sup>1/</sup> Relative weights (w) are based on nd<sup>2</sup> = 100 = 1.0

In estimating site index, the following limitations should be considered:

1. The index will not apply to any stands whose development, because of climatic or soil peculiarities, is expected to be widely different from the average trend portrayed by the curves. The curves assume that percent deviation of observed height above or below the central trend remains constant throughout the life of the stand.
2. The site index cannot be properly evaluated in stands where dominant and co-dominant trees have been affected by past suppression.
3. The curves should not be applied to extremely dense or very open stands where stagnation or excessive crown development is observed.

STATISTICAL PROCEDURE LEAFLET #8How to Calculate the Limit of Error in Area

In systematic-grid sampling each plot may be considered to represent a constant number of acres--the total forest area divided by the total number of plots. For a 162,000 acre forest having a total of 600 plots, there would be 270 acres-per-plot.

The area occupied by a forest cover type (or other area-breakdown) may be calculated by multiplying the acres-per-plot by the number of sample plots classified as being in the type. If 150 plots were classified as being in spruce-fir cover type, the estimated area in this type would be 270 acres-per-plot x 150 plots = 40,500 acres.

In the data processing machines, addition is substituted for multiplication--with identical results. Acres-per-plot is emitted 1/ into each plot total summary card as it is created. As these summary cards are totalled for each area-breakdown, acres-per-plot is added up along with the other plot totals--number of trees, volume, basal area, etc, (270 acres-per-plot added from each of 150 spruce-fir plot total summary cards equals 40,500 acres).

Just as we check the statistical accuracy of volumes, we shall wish to make a statistical check of areas. The formula is quite simple.

$$Ea = \pm t \sqrt{\frac{N - Na}{N \times Na}}$$

- t is the probability factor (t = approx. 2 for 95% probability) 2/  
 N is the number of plots in the TOTAL FOREST area  
 Na is the number of plots in the area BREAKDOWN  
 Ea is the limit of error in the area of the breakdown (a decimal)

EXAMPLE

- t = 2  
 N = 600 plots (total on forest of 162,000 acres)  
 Na = 150 plots (classified spruce-fir)  
 Ea = limit of error in estimated 40,500 acres in spruce-fir

$$\begin{aligned} Ea &= \pm 2 \sqrt{\frac{600 - 150}{600 \times 150}}, \quad \text{or} \quad \pm 2 \sqrt{\frac{450}{90,000}} \\ &= \pm 2 \sqrt{0.005000} \\ &= \pm 2 \times (0.072) \\ &= \pm 0.144, \quad \text{or} \quad 14.4 \text{ percent} \end{aligned}$$

The limit of error in the 40,500 spruce-fir cover type acreage is 14.4%, or ± 5,832 acres.

1/ The machine is instructed to punch this figure in each card.

2/ See Statistical Procedure Leaflet #4 for discussion of probability.